



JECRC Foundation



**JAIPUR ENGINEERING COLLEGE
AND RESEARCH CENTRE**

JAIPUR ENGINEERING COLLEGE AND RESEARCH CENTRE

Year & Sem. – B. Tech I year, Sem.-I

Subject –Engineering Chemistry

Unit – IV

Presented by – Dr. Seema Joshi

Designation - Professor

Department - Chemistry

VISION OF INSTITUTE

To become a renowned centre of outcome based learning, and work towards academic, professional, cultural and social enrichment of the lives of individuals and communities.

MISSION OF INSTITUTE

- ❖ Focus on evaluation of learning outcomes and motivate students to inculcate research aptitude by project based learning.
- ❖ Identify, based on informed perception of Indian, regional and global needs, the areas of focus and provide platform to gain knowledge and solutions.
- ❖ Offer opportunities for interaction between academia and industry.
- ❖ Develop human potential to its fullest extent so that intellectually capable and imaginatively gifted leaders may emerge.

Engineering Chemistry: Course Outcomes

Students will be able to:

CO1: Explain the impurities of water (mainly hardness) and boiler troubles.

CO2: Describe processing technologies of fuel with numerical aspects of combustion of fuel.

CO3: Describe the engineering material (cement, glass and lubricant) with respect to their manufacturing, composition, classification & properties.

CO4: Explain corrosion with its controlling measures, organic reaction mechanism and synthesis of drugs (Aspirin & Paracetamol) with their properties and uses.

JECRC
Department of Applied Sciences
Lecture Plan (Session- 2020-2021)

Course Name: Engineering Chemistry

Year/Semester: 1st Year/ Semester- I

Course code: 1FY2-03

No. of Lecture Req. /(Avl.): /(40/44)

Semester starting: 21 Sept. 2020

Semester Ending: 24 Dec. 2020

Unit No./ Total Lect. Req.	Topics	Lect. No.	Date of Delivery	Book Referred	Pg. No.
Unit-I 10	Introduction to syllabus, Common natural impurities, hardness, Degree of hardness,	1		Engg. Chemistry (New Age International)	2-12
	Units of hardness, Determination of hardness by complexometric (EDTA method).	2		Engg. Chemistry (Jain & Jain)	
	Municipal water supply, Requisite of drinking water, purification of water, Sedimentation,	3			
	Filtration, disinfection, Breakpoint chlorination.	4			
	Boiler troubles: Scale and Sludge formation, Internal treatment Methods	5			
	Priming and Foaming, Boiler corrosion and caustic embrittlement	6			
	Water softening: Lime-Soda process	7			
	Water softening: Zeolite (Permutit) process, Demineralization process.	8			
	Numerical problems based on Hardness, EDTA,	9			
	Numerical problems based on Lime-Soda and Zeolite process.	10			

Unit-II

10

2.Organic Fuels: Solids fuels: Coal, Classification of Coal, Proximate analyses of coal and its significance	11		Engg. Chemistry (Jain & Jain)	116-117
Ultimate analyses of coal and its significance,	12		Engg. Chemistry (Jain & Jain)	117-118
Gross and Net Calorific value, Determination of Calorific value of coal by Bomb Calorimeter.	13			
Metallurgical coke, Carbonization processes; Otto-Hoffmann byproduct oven method.	14			
Liquid fuels : Advantages of liquid fuels, Mining, Refining and Composition of petroleum, Cracking	15			
Synthetic petrol, Reforming, Knocking, Octane number, Anti-knocking agents, Cetane number	16			
Gaseous fuels; Advantages, manufacturing, composition and Calorific value of coal gas and oil gas	17			
Determination of calorific value of gaseous fuels by Junker's calorimeter, Numerical problems based on Junkers calorimeter	18			
Numerical problems based on determination of calorific value bomb calorimeter, /Dulong's formula, proximate & ultimate Analysis.	19			
Numerical problems based on combustion of fuel.	20			

Unit-III

3

3. Corrosion and its control: Definition and significance of corrosion, Mechanism of chemical (dry) corrosion

21

Mechanism of electrochemical (wet) corrosion, galvanic corrosion, concentration corrosion and pitting corrosion.

22

Protection from corrosion; protective coatings-galvanization and tinning, cathodic protection, sacrificial anode and modifications in design.

23

Unit-IV

10

4.Engineering Materials: Portland Cement; Definition, Manufacturing by Rotary kiln.	24			
Chemistry of setting and hardening of cement. Role of Gypsum.	25			
Glass: Definition, Manufacturing by tank furnace, significance of Annealing	26			
Types and properties of soft glass, hard glass	27			
Borosilicate glass, glass wool, safety glass.	28			
Lubricants: Classification	29			
Lubricants: Mechanism	30			
Properties; Viscosity and viscosity index	31			
Flash and fire point, cloud and pour point.	32			
Emulsification and steam emulsion number.	33			

Unit-V

7

5. Organic reaction mechanism and introduction of drugs: Organic reaction mechanism: Substitution; SN1, SN2.	34			
Electrophilic aromatic substitution in benzene, free radical halogenations of alkanes,	35			
Elimination: elimination in alkyl halides, dehydration of alcohols,	36			
Addition: electrophilic and free radical addition in alkenes, nucleophilic addition in aldehyde and ketones	37			
Rearrangement: Carbocation and free radical rearrangements	38			
Drugs : Introduction, Synthesis, properties and uses of Aspirin	39			
Drugs : Introduction, Synthesis, properties and uses of Paracetamol, Revision	40			

Lecture-31(Unit-IV) :

Mechanism of Lubrication

CONTENTS:

- Fluid-film or thick film or hydrodynamic lubrication
- Boundary lubrication or thin film lubrication
- Extreme pressure lubrication

Fluid-film or thick film or hydrodynamic lubrication

Thick film lubrication is there when

- load is less
- Velocity is high
- Viscosity of the oil is very low.

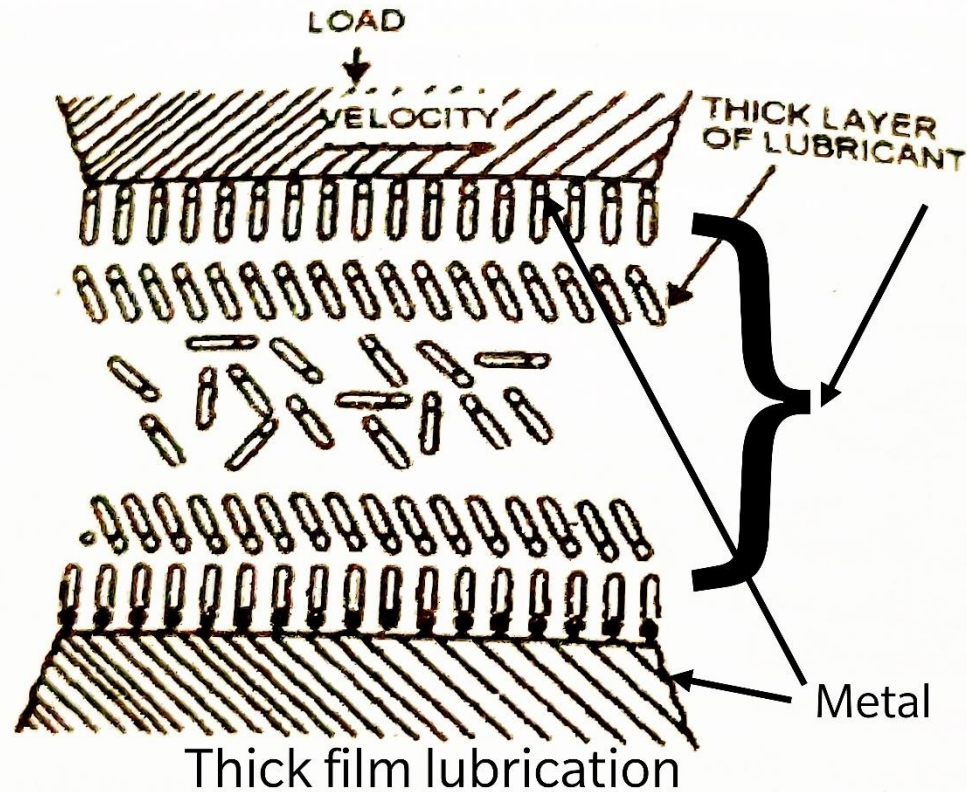
Fluid-film or thick film or hydrodynamic lubrication

For such systems the coefficient of friction is as low as 0.001 to 0.03.

Delicate machineries like watches clocks guns sewing machines and scientific instruments are provided with this type of lubrication.

To maintain the viscosity all through the season of The year ordinary hydrocarbon lubricants are blended with certain long chain polymers.

Fluid-film or thick film or hydrodynamic lubrication



Boundary lubrication or thin film lubrication

Under these conditions boundary lubrication occur,when

- The speed is very low
- The load is very high
- Viscosity of the oil is low
- The shaft starts moving from rest,

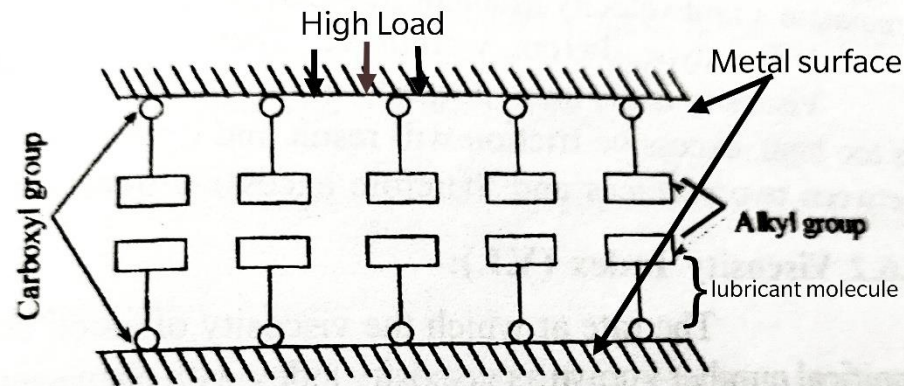
In which lubricant can interact with solid surfaces of the metal by physical or chemical forces.

Boundary lubrication or thin film lubrication

In this type of lubrication a thin film is interposed between the two surfaces. this film remain between two rubbing surfaces and metal to metal contact is not possible.

Thickness of this film should be less than 1000 \AA and coefficient of friction is 0.05 -0.15. the property of oil responsible for its adsorption on metal surfaces is known as oiliness.

Boundary lubrication or thin film lubrication



Boundary lubrication

Extreme pressure lubrication

Under the impact of high speed and greater load in a system particularly related to automobiles, layers of lubricant are broken, erupted and two metal surfaces come into contact. This contact of metal bearing under high speed and high load generates heat which causes harmful effects...

Extreme pressure lubrication

This contact of metal bearing under high speed and high load generates heat which causes harmful effects...

- Formation of welded junction(metal seizures) and metal tearing
- Deformation takes place
- High local temperature causes change in physical and chemical characteristics of lubricant so it fails to stick to the surface and becomes ineffective.

Extreme pressure lubrication

To overcome above extreme pressure difficulties certain additives are added to lubricants so that lubricant sustain the extreme pressure and temperature and continue to maintain lubricant characteristics. Additives in this regard are

- Oxygen containing compounds such as fatty acids, esters and ketones
- Sulphur or Sulphur with oxygen containing compounds in sulfurized oils
- Organic compounds having trivalent or pentavalent phosphorus eg. Tricresyl phosphate.

Question Bank

Q1 Write different function of lubricants.

Q2 Define lubricant.

Q3 What do you meant by Steam Emulsion no.(SEN)(RTU 2011, 2013, 2014)

Q4 Write Classification of Lubricant with example.

Q5 Explain Thin film/ Extreme pressure lubrication. (RTU 2010, 2012, 2015) .

Q6 Explain different mechanisms of lubrication in detail.

Q7 Define the terms lubrication and lubricants? What are different types of lubricants? Discuss extreme pressure lubrication.

Q8 Write short note on:

(i) Thin layer mechanism of lubrication

(ii) Mechanism of thick film lubrication

Question Bank

Q.9 Which mechanism of lubrication would be suitable when load is less and velocity of moving parts is high? Explain.

Q.10 What is the value of coefficient of friction in hydrodynamic lubrication and boundary lubrication? Why it is less in hydrodynamic lubrication, Give reasons.

Q.11 A machine is working at 295°C under high pressure. What is the mechanism of lubrication in the above said conditions? Suggest suitable type of lubricant which can be used under such conditions.

Q.12 What should be done to prevent formation of welded junctions in machine parts?

Q. 13 What happens when greases are used at high temperature conditions?

Practice Questions contd.....

Q.1 Grease is a Lubricant.

- a) Solid b) Liquid c) Semi solid d) None of these

Q.2 The purpose of lubrication is

- a) to reduce friction b) To reduce wear c) Transfer heat produced d) All

Q.3 Which of the following is not a function of lubricant in IC engine?

- a) Form a film to separate the surfaces
b) Adhere to surface
c) Withstand high temperature inside the cylinder
d) Reduce the size of the asperities and improve the surface finish

Q.4 As the temperature is increased, the friction coefficient

- a) increases b) reduces c) Remains unchanged d) increase or decrease based on lubrication regime

Q5 Which of the following is a desirable property of boundary lubricant?

- a) Dissolvability in lubricating oils;(b) Affinity to metallic surfaces
c) Low shear strength and high melting point;(d) All of the above

Q.6 Viscosity index denotes

- a) Relationship between the dynamic and kinematic viscosities
b) Sensitivity of lubricants viscosity with respect to temperature
c) Both a and b
d) There is no sliding and only rolling motion involved between cage and balls

Suggested links from NPTEL & other Platforms:

- <https://nptel.ac.in/courses/112/102/112102015/>
- <https://nptel.ac.in/content/storage2/courses/112102015/downloads/faq%20of%20module%204.pdf>
- <https://www.youtube.com/watch?v=WQ8v-UcACTE>



JECRC Foundation



**JAIPUR ENGINEERING COLLEGE
AND RESEARCH CENTRE**

*Thank
you!*